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A REVIEW OF THE BOX TURTLES

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Early in 1933, at the request of Mr. Madison Grant, the president of the New York Zoological Society, and a student of turtles for many years, I started the preparation of an article about the box turtles. The idea was to review the species collectively, as descriptions were scattered.

At the beginning, the preparation of this article seemed comparatively simple. There appeared to be but slightly over half a dozen species in the genus, a fair assortment of specimens representing the greater number of them was at hand, and upon gross examination specific differences appeared rather simply defined. Edward Osterndorff, of the Society's photographic department, set to work to prepare an extensive series of illustrations.

Examination of the literature, however, coupled with close inspection of our specimens, convinced me that *Terrapene* is a genus to be handled with caution. Relationship is close, and points used in former keys have been demonstrated not to hold.

Since W. E. Taylor, under date of May 11, 1895, published in the Proceedings of the United States National Museum* a sixteen-page paper entitled The Box Tortoises of North America, a search revealed no detailed reviews of the genus relating both to taxonomy and illustrative material.

Taylor recognized the following species of *Terrapene*: *T. major*, of the Gulf States; *T. bauri*, indicated to be restricted to the Florida peninsula; *T. carolina*, of easterly North America, from Canada to Georgia and westward to Michigan; *T. mexicana*, "Mexico"; *T. triunguis*, westerly Tennessee to Oklahoma and the Gulf; and *T. ornata*, east of the Rockies to Illinois and Texas.

*No. 1019, pp. 573-588.

During the thirty-eight years since Taylor's *resumé*, three species have been added to the genus. These are *T. yucatana*, of southeastern Mexico; *T. nelsoni*, of southwesterly Mexico; and *T. goldmani*, also of Mexico.

The synonymy of the genus shows that *Terrapene* was proposed by Merrem in 1820, to include *Testudo carolina* of Linnaeus. In 1822, *Cistudo* was proposed by Fleming. The latter generic term was adopted in various lists, although there is now uniform reversion to the older title.

Going back to the building of the group, we note that in 1849, in the Proceedings of the Zoological Society of London, Gray described *Cistudo mexicana*, and in 1857 Agassiz, in his Contributions to the Natural History of the United States, described *Cistudo virginia* (Gmelin), *C. triunguis*, *C. ornata* and *C. major*, the first being *Testudo carolina* of Linnaeus, while the last three were recognized as new species. Succeeding years subjected the proposed species to various vicissitudes as to standing.

Günther, in Biologica Centrali Americana, Reptiles, April 1885, page 1, states his deductions regarding the genus: "Gray was the first who specifically separated from the common type of North American Box Tortoise a form whose hind feet are armed with three large claws instead of four. However, in examining the value of this character, Agassiz (Contr. Nat. Hist. Amer. 1. pg. 444) came to a different conclusion, stating that the outer toe of the hind foot fades away gradually; and, whilst he distinguished not less than four different species of *Cistudo*, these species included three—as well as four-toed specimens.

"In a case in which one naturalist, though he has examined many hundred specimens, does not feel justified in expressing a decided opinion, it would be most hazardous for another to do so who has much less material at hand. Yet, having seen specimens of Agassiz's four species, I may be allowed to say that I incline to the belief that there is, in fact, one species of Box-Tortoise only, and that one of its hind toes becomes aborted in the south-western and southern range of its distribution. Nevertheless, I have considered it best to retain the name given by Gray, the more so as both the typical specimens are singularly

distinguished by having a small additional scute intercalated between the fourth and fifth, so that there are six vertebrals altogether. This, of course, may be an abnormal condition peculiar to the locality where the specimens were obtained, and which unfortunately is not known. They are simply marked 'Mexico'."

Boulenger in the Catalogue of Reptiles of the British Museum, 1889, recognized but two species, although he conceded he had insufficient material for satisfactory diagnosis. He described *major*, *cinosternoides (triunguis)* and *mexicana* as subspecies of *Cistudo carolina*. The other full species in his list was the western *C. ornata*.

In 1895, however, Boulenger, in the Annals and Magazine of Natural History, Vol. XV, Series 6, London, pp. 330-331, presents a key "On the American Box Tortoises" in which he recognizes as full species *Cistudo major*, *C. yucatana*, *C. mexicana*, *C. cinosternoides*, *C. carolina* and *C. ornata*. In this article is the description of a new species, *C. yucatana*.

In Taylor's article of 1895, a new species for the United States, *Terrapene bauri*, is described. This species failed to endure general acceptance. It was later accorded recognition as a subspecies of *major*, and later dropped to the synonyms under that species. *T. triunguis*, accorded specific recognition by Taylor, was later designated as a subspecies of *carolina*.

In 1925, Stejneger added a new species to the group, *Terrapene nelsoni*, from Mexico, and in 1933, another new species, *T. goldmani*, also from Mexico. In 1933, in the Check List of North American Amphibians and Reptiles (third edition), by Stejneger and Barbour, *T. triunguis* is again accorded full specific recognition, and *T. bauri* is taken from the synonymy and accorded specific rank.

From external examination, points warranting full specific recognition of several members of the list, have not been satisfactorily clear. *T. carolina* and *T. triunguis* appear to be very closely related, a condition also indicated with *major* and *bauri*. Skull characters have been utilized in diagnosis; also the number of phalanges.

The recognized status of the genus *Terrapene*, now stands as follows:

Terrapene carolina (Linnaeus) Eastern United States from Maine to Georgia; westward to Michigan.
Terrapene triunguis (Agassiz) Gulf of Mexico to Missouri; westward to Oklahoma.
Terrapene major (Agassiz) Southern Georgia and northern Florida; westward to Texas.
Terrapene bauri Taylor Peninsula of Florida.
Terrapene ornata (Agassiz) Indiana to the Rockies; southward to northern Mexico.
Terrapene mexicana (Gray) "Mexico."
Terrapene yucatana (Boulenger) Southeastern Mexico.
Terrapene nelsoni Stejneger Westerly central Mexico.
Terrapene goldmani Stejneger Easterly central Mexico.

Curiously enough, two very similarly marked species are widely separated in *habitat*. As to the probability of the rather recent origin of specific differences among box turtles, Taylor says:

"The closeness of the relations of the species would seem to indicate that our forms are varieties rather than species. However, at least two difficulties are in the way of this conclusion. First, there can be no question but that if we take two extremes of developments of the species of the genus, for instance, *T. major* and *T. ornata* or *T. carolina* and *T. ornata*, we must recognize them as separate species. But since other intermediate forms seemingly connect these species, if the closeness of relations be considered as indicating varietal characteristics only, we are forced to consider all species as varieties, a conclusion that would seem to be erroneous. Second, while the relations indicated by a study of the different species seems close, yet the distinctions seem definite and fixed, even where the ranges of the species overlap. The study of a number of specimens seems to indicate that the different species are derived from one form, and that afterwards, by isolation, caused possibly by geological and climatic agencies, they became distinct. When we remember the comparatively fixed abode of these animals it seems reasonable to suppose that these changes might have been brought about by relatively simple agencies which need not necessarily have acted simultaneously. Hence, it would seem proper to classify each

form as a distinct species, each possessing certain fixed osteological characters. If these conclusions be true then it would seem most reasonable to suppose that *T. ornata* has become more distinct from the other species by its comparatively longer isolation, aided by the generally arid climate of its habitat."

In the various groupings of the order *Testudinata* marked differences in the skull structure are to be noted. Considerable differences even exist among species of the respective groups. These differences particularly relate to the bones bordering the temporal area. As extremes of these differences are *Terrapene* and *Dermochelys*. In the former, there is no bony, temporal covering, while the latter has the whole temporal region encased under heavy osseous roof. The absence of temporal encasement with *Terrapene*, is associated with reduction to remnants of the lateral bones defined as the quadratojugal and the jugal. This condition differs, however, among the species. Differentiation in the relative size of the quadratojugal and the jugal, and the presence or absence of a zygomatic arch has formed a basis for diagnosis. Taylor, and later, Boulenger stressed this point and utilized it in the formation of keys of the genus. Lönnberg, however, has indicated that Taylor's osteological definitions, do not hold.* The point is open for further study with extensive series of specimens.

Gray overlooked the rudimentary quadratojugal in *T. carolina*, and Agassiz in defining the genus speaks of the temporal arch as "either cartilaginous or only partially ossified," then describing a new species, *T. major*, yet omitting mention that a zygomatic arch formed by a fusing of the quadratojugal with the jugal, produced a connection between the area of the quadrate close to the tympanic cavity and the margin of the orbit. Taylor points out that with *T. carolina*, *T. triunguis* and *T. mexicana* the zygomatic arch is incomplete and with *T. ornata* it has practically disappeared—with the exception of a vestigial trace of the jugal. This method of diagnosis is defined by Taylor, in a plate, which appears satisfactorily convincing. It was Dr. G. Baur, of the University of Chicago, who in working upon the taxonomy of *Terrapene* first pointed to the modification of the zygomatic arch as providing a definite working basis in separating species other-

*Proceedings of the United States National Museum, Vol. 19, 1896, p. 253.

wise difficult to define. Taylor explains that his work was a continuation of the investigation begun by Baur.

In preparing a *résumé* of the recognized species of box turtles, the author has gone through a considerable series of publications in search of data, and the descriptions to follow form composite outlines of the more important points, also including field notes and some original observations made by the author. The illustrations, at the conclusion of this article, are, so far as the author is aware, the most complete studies of the genus ever brought together, as all the known species are represented, and color sensitive plates were employed in bringing out details of pattern. For several important photographs, of type specimens, I am indebted to Dr. Leonhard Stejneger, who sent me the pictures from the files of the United States National Museum.

General description: Upon gross examination, the shells, both carapace and plastron of most of the species of *Terrapene*, show no great differences. All are rather high and globular, some proportionately higher than others, and again, there are differences in the proportionate lengths and widths. With some species there is a tendency for the posterior margin of the upper shell to flare, outward and upward, particularly with the males. This tendency, however, even with a given species may show marked variation. With all the species, the plastron is divided into two movable lobes, separated from each other and from the carapace by ligamentary structure. There is no bridge, as with some of the water turtles having movable sections of the plastron. The transverse hinge and movable halves of the lower shell are of such highly perfected development that the head, limbs and tail may be withdrawn and the plastron closed tightly like a box, the margin of closing, with most specimens, so precisely matched, that it is impossible to insert a broom straw at any portion.

All of the species of *Terrapene* are quite terrestrial, their habits rather closely approaching the species of typical tortoises, *Testudo* and allies, which, in their specialization for a life remote from water, have lost all traces of the webbed digits of their more numerous, aquatic allies. The relationship of *Terrapene*, however, is much closer to the water turtles, as indicated by remaining traces of webbing upon the hind feet of several of the

species. Moreover, the members of this genus are not so much inclined to frequent particularly dry areas as with *Testudo* and immediately related genera. Most of the box turtles select woodland areas, even places which may be quite damp. They wander into the margins of swamps and infiltrated borders of brooks, in which situations examples may sometimes be found half buried in soggy soil. While these tendencies point to lingering, hereditary influence of aquatic, ancestral forms, they are but poor and clumsy swimmers owing to their globular shells and stout, comparatively webless feet.

The feeding of all members of the genus is similar to that of the typical tortoises, being partially herbivorous, varied with insects, particularly the larval forms, small snails, slugs and earthworms. Berries are a favorite part of the diet.

A detailed outline of the species follows:

Terrapene carolina (Linnaeus)

EASTERN BOX TURTLE; COMMON BOX TURTLE; BOX TORTOISE

Testudo carolina, Linnaeus, Ed. 10, Syst. Nat., Vol. 1, 1758, p. 198.

Distribution: The species has a broad range, although not so extensive as the western *T. ornata*. *T. carolina* occurs from Maine to Georgia, westward to Tennessee, western Illinois, and northward to central Michigan. Its distribution in most of the states within this area is "spotty," and while this condition has long been the case owing to box turtle preference for thin woodland, or brushy areas, occurrence is becoming more restricted from widening of roads and motor traffic, resulting in the killing of many turtles which endeavor to cross the highways. The species is common, however, in many localities, even in some of the wooded suburban areas surrounding New York City.

During the spring of 1933, the author received over a dozen specimens, from the restricted reservoir areas of Westchester County, New York, which tracts are serving as shelters for various wild creatures—even to fair numbers of poisonous serpents. Specimens were also brought in from the woods at the top of the

Palisades of the Hudson, which have also come to be under protection. A series of several dozen box turtles was received from Long Island, where *T. carolina* is quite common on the North Shore, in the vicinity of Gardiner and Shelter Islands. Specimens were also observed on Gardiner Island during 1933. Relating to the box turtle on Long Island, Mr. Madison Grant explains: "Box turtles have been very common on Long Island. In my boyhood they were to be found on my grandfather's place, which is now Belmont Park. Twenty years later they were found in abundance back of Oyster Bay, and more recently they were very numerous east of Southampton."

Pointing to present abundance of box turtles in some portions of Long Island, is the following observation of Mr. William R. Potts, of Cold Spring Harbor:

"The pond where I have found the box turtles is about three miles south of Huntington, Long Island. It is really more of a mud hole than a pond, having no apparent inlet or outlet, but is fairly deep in the middle and about two hundred yards in circumference.

"The turtles congregate in the mud around the edge and you can sometimes pick up three or four in one scoop.

"I collected about forty of them yesterday" (July, 1933) "and tried to get a picture of them all together. I will send it to you if it comes out."

As it is of interest, at least with the box turtles of the United States, to outline skull characters as a possible aid in definition of species, an examination of a plate in Taylor's article,* points to the following specific deduction for *T. carolina*: Quadratojugal vestigeal, triangular and connected only with the quadrate. Hence there is an absence of the zygomatic arch.

There are four claws on the hind foot, which is slightly webbed. With male specimens, the front and rear margins of the upper shell usually flare outward, and with some individuals curl upward. There is considerable variation in this marginal shell flare. With most females it is but slightly apparent, some examples being of globular outline, the lateral declivity plunging sharply downward, with no protrusion at any portion of the margin.

Pattern, both above and beneath, is extremely variable, but this species may be said to generally display the coarsest mark-

*Later disputed by Lönnberg.

ings of the genus; with least tendency of the yellow markings to become linear and radiate from the center of the shields. The markings may consist of short, yellow bands, arranged in irregular groups in each shield, or of bands that run together on the sides to form broad E-like markings. The plastron may be dark brown, black, or blotched with yellow. Male examples usually have bright red eyes and heads brightly blotched or speckled with yellow.

Dimensions: The measurements of an adult male from the state of New York are as follows: Length of carapace $5\frac{5}{8}$ inches; width of carapace, $4\frac{3}{4}$ inches. Height of combined shell, $2\frac{1}{2}$ inches.

Habits: There is similarity of habits among all the species of box turtles and a summary of observations relating to *T. carolina* produces a composite picture of the genus.

From field observations the author is convinced that box turtles dig no burrow in which to take shelter. Owing to this, they differ from typical tortoises (*Testudo* and allied genera), to which they otherwise show parallelism in form and terrestrial habits. They have a habit, however, when resting, of partially imbedding the shell by successively shoveling with anterior limbs and hind feet, thence by twisting and forcing the shell into the loosened soil, covering its marginal area. A specimen, thus half imbedded, is difficult to detect.

Like other terrestrial members of the order, it appears that box turtles live to a considerable age. The writer has three authoritative records, of thirty-three years, thirty years and twenty-seven years, respectively. All of these specimens were adult when first placed under observation, so their actual ages, over the periods mentioned, are subject to conjecture. The specimen under observation for twenty-seven years, is shown on an accompanying plate. It lived the greater part of the time in the kitchen of a farmhouse, which, eliminating opportunity to scratch and dig in soil, may account for its exceptionally long claws. Its mandibles also grew to be abnormally elongated.

The specimen under observation approximately thirty-three years is described by Mrs. Margaret A. Gruner, of New York City, as follows:

"Relative to the age of the box turtle I had you send for, and which you have at the Park now, I wish to say that when I was a girl at the age of six or seven, which is nearly thirty-three years ago, I remember this turtle walking about my father's farm, which was then where the Yankee Stadium now stands. It was the only box turtle ever around the place and it kept itself in and around the glass-covered hot beds.

"When our house was torn down and the steam shovels started work there was some deep digging for a garage. It was then that my father, George Einberger, saw our turtle, crawling between the curb and the sidewalk. Father took him to our store. Since then we sold the store and I have had him in the apartment here for over a year. Now I hope he will spend a long time at the Bronx Zoological Park."

The specimen thus described by Mrs. Gruner showed a tendency for elongation of claws and upper mandible, as seen with the example under observation for twenty-seven years, but the condition was not so pronounced, owing probably, to this turtle living the greater part of the time under more natural conditions.

In the radiating specialization of the *Testudinata*, the tendency in reproduction has been for the development of a large number of eggs among the species of marine turtles, a moderate number among the fresh-water species and around six or less among terrestrial kinds. The small clutches of eggs noted among box turtles indicate a parallelism of habits with the more highly specialized terrestrial kinds.

The eggs of box turtles are ovoidal and covered with a thin, but hard shell. Available records indicate that four to six eggs are laid, the writer having no data citing a greater number than six.

Mr. and Mrs. William R. Potts have made extensive studies of box turtles. They have kindly furnished the author with the record of a box turtle laying four eggs on the 21st of June, at Oyster Bay, Long Island. The female excavated a hollow with her hind feet, during the early evening. She then carefully scraped loose soil into the hollow until the ground was level. Mr. Potts transferred the eggs to his garden and after five weeks opened one of them. It contained a well-developed embryo. Two of the eggs were accidentally destroyed by children and the remaining eggs hatched on the 21st of September, the freshly-emerged turtle working its way to the surface through well-packed soil. At the time of hatching it was "about the diameter

of a nickel, was taken indoors, and by November 10th had increased about one hundred per cent in size." It was photographed on November 10th alongside a rule and the illustration accompanies this text.

Miss Marion Bush, of New York City, and with a summer home in Connecticut, has made detailed studies of box turtles over a number of years. She has kindly furnished the following notes:

"On the 22nd of June, 1927, I saw a female lay her eggs (six) near my home in Connecticut. I protected the nest with wire netting. On the 9th of October the first of the young came out of the ground. On digging down, I found another free of the shell and with the egg yolk absorbed. A third was still in the shell, but came out in my hand a few hours later.

"Two of the young turtles are now alive (1933) and have made what seems to me a satisfactory growth. The band developed each year, seems wider and smoother, than those I have noticed on wild specimens. I have also three young turtles that were hatched October 8th, 1932. The eggs were given to me by a farmer and I was obliged to construct the nest myself. The young turtles do not seem to be as vigorous specimens as the first, I imagine because the nest did not get enough sun."

One of the slightly more than five-year-old examples described in Miss Bush's observations, was brought by her to the Zoological Park, and photographed as a record for this article. It is of mature dimensions, illustrating that a box turtle may attain adult size in this period.

Among other observations made by Miss Bush, are the following:

"As to the time of day at which the eggs are laid:—The female comes to select a place about six o'clock in the evening, at a time when turtles have generally retired for the night. My theory is that the hour is chosen in order that she may be free from interruption, as the male turtle is a most ardent and inconsiderate wooer, apparently ready to mate at any season of the year. The mother of my five-year-old turtles appeared in the lane in front of my house at about six o'clock and was seen digging for some time ineffectually in the stony ground. At last I moved her to a place on the other side of the lane, where I knew box turtles had nested in other years; for I had seen torn-up nests and scattered eggs-shells—the work of skunks, I imagine.

"Having placed her on good nesting ground, I went in to dinner. About an hour later I returned to find she was well started in digging, the whole process being performed by the hind feet. The hole, when it was ready to receive the eggs, must have been about three inches deep, though I didn't dare to get too near, for fear of disturbing her, to make a very exact observation. As the eggs were dropped she arranged them carefully with her hind feet, the claws turned outward to avoid contact with the shells. When the eggs had been laid, she began scraping the earth over them, a

process that seemed endless, for when the ground was perfectly smooth she was still at it leveling away to leave no trace.

"By that time, about nine o'clock, it was just light enough to see what I was about, and lifting her up, still scraping, I covered the nest with wire netting.

"It was during the same week that I walked to a spot where I knew turtles were abundant to see if there were any nesting females and at about the same time of the evening—between six and seven o'clock—I found at the edge of the woods, a very ancient female. Her carapace was absolutely smooth, the edges so worn that there was no flare whatever. She had been marked with a date in the rather unusual place, across the anterior half of the plastron. The date was 1809—nearly worn away—but I think there is no doubt about it, and judging from the extreme age of the turtle, I believe it was a true date. I can hardly believe that so old a turtle could still be reproductive, but the old midsummer tradition still called her forth at the appointed time. I did not see her make any attempt to dig.

"One morning about the middle of June, as I was crossing a pasture lot, I came upon a group of three box turtles, two males, which had evidently been fighting and a female rolled on her back, her plastron tightly closed. Unfortunately, I could not wait to see what finally happened. A curious instance of fighting, for sheer love of fighting, came to my attention some years ago. In walking through the fields I collected a number of box turtles, which I set free almost immediately. One was an unusually handsome male, quite unblemished except for a curious scar across his nose.

"After carrying him a little I put him down in company with a smaller (but older male). Chancing to come upon them later, I found the one with the scarred nose making the most furious onslaughts on the other, who had wisely shut himself up and was impervious to attack. The attacker continued to make lunges until his nose was torn and bleeding from the contact with the other's shell. Finally he succeeded in turning his victim upon its back, whereupon he planted his feet firmly upon the closed plastron and stood with neck outstretched, lacking only the voice to crow over his victory. Then I understood the meaning of those scars, a condition which I have never observed in any of the box turtles I have examined before or since."

Terrapene triunguis (Agassiz)

THREE-TOED BOX TURTLE,

Cistudo triunguis, Agassiz, Contributions Nat. Hist. U. S., Vol. 1, 1857, p. 445.

Distribution: Coastal plain of the Gulf of Mexico from southern Georgia to southeastern Texas and into the Mississippi basin as far north as Missouri and westerly into Oklahoma.

For a number of years *triunguis* has been relegated to the status of a subspecies of *carolina*. In the third edition of the Check List of North American Reptiles and Amphibians, by Stejneger and Barbour (1933), it is again accorded full specific

rank. Taylor, who accorded it specific recognition, points out that the quadratojugal is rudimentary and triangular, connected only with the quadrate—hence the zygomatic arch is absent. In that regard, he explains, there is close similarity to *carolina*. Other points to be considered are the absence of webs between the digits, and only three claws on the hind foot, which is comparatively much narrower than with *carolina*.

Dr. Harold L. Babcock, Curator of Reptiles of the Boston Society of Natural History, in a letter to the author, says: "Recently I went over the group (box turtles) in the collection of the Museum of Comparative Zoology and * * * it seems to me that there are five distinct forms in the United States; 1, *T. bauri* Taylor; 2, *T. carolina* (Linnaeus); 3, *T. major* (Agassiz); 4, *T. ornata* (Agassiz), and 5, *T. triunguis* (Agassiz). To be sure these five forms are not of equal value, but the distinctions are fixed and definite even where overlapping in range occurs.

"I sent my findings to Dr. Stejneger for criticism and he replied that he was prepared to elevate *triunguis* again to full specific rank in the forthcoming edition of the Check List."

The carapace of the Three-toed Box Turtle is moderately oval, keeled and slightly compressed. Coloration is variable. The ground color is brownish, mottled, streaked or spotted with yellow, which may be more or less obscure. Horn-colored, dull olive or yellowish specimens are commonly found. Dimensions are similar to *T. carolina*, though there is an indicated tendency of slightly lesser size.

Terrapene major (Agassiz)

GULF COAST BOX TURTLE

Cistudo major, Agassiz, Contributions Nat. Hist. U. S., Vol. 1, 1957, p. 445.

Distribution: Southerly Georgia and northern Florida, westward along the Gulf to southeastern Texas.

Boulenger's condensed description reads: "Larger and more oval, less gibbose" (than *carolina*). "Hook of upper jaw notched,

bicuspid. Digits shortly but very distinctly webbed. Carapace brown with yellow spots, or yellowish olive with dark brown dots and margins to the shields; plastron yellow, the sutures between the shields blackish. Head and limbs brown with yellow or orange spots."

Taylor points out that the zygomatic arch is complete and relatively broader than with what appears the nearest related species—*T. bauri*.

Largest of the species occurring in the United States, and attaining a length of carapace, by straight calibration, of slightly over seven inches.

Olive or uniform horn-colored examples, without spots, are not uncommon. With well-marked examples the yellowish pattern is usually seen as separated, radiating bands or streaks. There may be a spot-like formation, but without tendency to form a fused, central pattern within the shields as with *carolina*. The plastron is yellowish, or olive, and usually free of markings except for bordering of dark brown or black between the shields.

Taylor says: "Terrapene major may be said to be strictly a gulf species, having for its range the gulf coast from the Rio Grande to Florida, possibly including southern Georgia. The specimens examined by me seem to be larger in the average than individuals of other species, and in general osteological characters they certainly represent the primitive form of the genus. They possess a well-developed quadratojugal, a complete zygomatic arch, and are distinguished from *T. bauri* by the number of phalanges, color pattern, and webbed digits, there being four claws on each hind foot."

The "four-clawed" diagnosis fails to uniformly hold. In a letter from Dr. Babcock, of Boston, is the note: "* * * I have seen a typical *T. major* with three claws." The author, in going through a recent series of *T. major* from Georgia, found both three- and four-clawed specimens.

In the easterly range, the markings of many examples are particularly linear and radial, so closely approaching the markings of *bauri* that the species are difficult to separate on gross examination. Also, to add to confusion, in series of *bauri*

(described as a three-clawed species) four-clawed examples are not uncommon. Thus *major* and *bauri* show close relationship, and of all the species of *Terrapene*, *bauri* appears to be the most dubious in full specific separation. Provisionally, it may be well to accord it full rank, but examination of further series of *major* from its easterly range may demonstrate such integradation as to prove *bauri* but a peninsula race, with reduced webbing and loss of claw (although not uniformly), resulting from pioneering into the sandy soil of the southeastern United States.

Terrapene bauri Taylor

BAUR'S BOX TURTLE; FLORIDA BOX TURTLE

Terrapene bauri, Taylor, Proceedings of the United States National Museum, Washington, No. 1019, May 11, 1895, p. 576.

Distribution: The peninsula of Florida.

Taylor's original description follows: "Quadratojugal well developed; zygomatic arch complete, though not as wide as in *T. major*. Webs absent. Number of phalanges in the forefoot, 2-3-3-3-2; hind foot, 2-3-3-2-1. Number of claws on the hind foot, 3.

"Carapace semicircular in transverse outline, imperfectly oblong in horizontal outline. Median ridge and keel distinct. First pleural plate more than three times as long as wide. Ratio of width to length of the carapace approximately 10 to 13.

"Ground color of the carapace dark brown, sometimes slightly olive, marked with yellow, arranged in radiating lines rather than single spots; keel yellow. The markings of the carapace bear a very close resemblance to the extreme western species *T. ornata*, a species from which it is entirely separated geographically. Plastron yellowish, with but few markings.

"The type (No. 8352, U.S.N.M.) was collected in Florida by F. B. Meek.

"The species is named for Dr. Baur, who first noted the peculiarities of the type, but having only the one specimen considered it as an exceptional individual of *T. triunguis*."

It will be noted that Taylor specifically mentions that *bauri* has three claws upon the hind foot. During the preparation of this article, however, the author received eighteen living specimens from Township 13, Range 23 East, Marion County, Florida. Of these specimens, six had *four* claws on the hind foot, and the balance had the normal (as described for the species) three claws. Some of the specimens had the upper (external horny) mandible deeply notched, while with others, the upper jaw was pointed. The notching of the upper mandible occurred indiscriminately among four- and three-clawed examples.

The author sent several of these specimens to Dr. Babcock, at Boston. All had similar markings, long and radial, but the author queried the four-clawed specimens, with notched mandibles as *major*, as both points of development came within the description of that species. Dr. Babcock examined the specimens, and replied:

"I should call all five specimens *T. bauri*, based on the following reasoning:—The individual variation is so great in all the Box Turtles that they have to be judged in groups. I have found notching of the upper mandible and webbing between the hind toes so variable as to be unreliable as specific characters. I did think that three claws was a good character, but I have seen a typical *T. major* with three claws, and two of your specimens have four. It seems to me that your specimens have the typical *T. bauri* build and pattern; fairly high shell usually with the highest point posterior to the middle, prominent keel and more elongate form. *T. major* is larger, broader and flatter, with a different color pattern. * * * Although Dr. Stejneger has taken *T. bauri* out of the synonymy and given it full rank in the new Check List, I know that he feels that the genus is so variable that a hard and fast key is at present impossible."

The specimens examined by Dr. Babcock were described by the collector, C. C. Tyler, as found under the following conditions: Open pine woods; hammock with small stream running through it; cypress pond dried up except small hole; thick pine woods next to branch hammock.

Terrapene ornata (Agassiz)

WESTERN BOX TURTLE

Cistudo ornata, Agassiz, Contributions to the Natural History of the United States, Vol. 1, p. 445, Pl. III, figs. 12, 13.

Distribution: Indiana, Illinois, and area between the Missouri and Mississippi Rivers and the Rocky Mountains from the Yellowstone River in the north to the Gulf of Mexico in the south, southern New Mexico and Arizona and northern Mexico. (Stejneger and Barbour).

Taylor says: "This species may be said to belong to the plains and the table lands. In Kansas, where it becomes extremely numerous, Prof. Cragin speaks of it as so abundant as to become a nuisance as a cumberer of the ground. It seems to subsist and thrive in our most arid climates, being found in the sand hills of Nebraska and the barren regions of New Mexico and Texas."

The species occurs broadly through Texas, ranging easterly well past the central portion.

This is a very distinct species among the box turtles. Its shell is particularly wide and globular, although flattened at the summit, and with slight, or no marginal flare.

Reverting to Taylor's method of diagnosis, its skull has been described as distinct in the entire absence of a quadratejugal. There are four claws on the hind foot. The average size is smaller than the eastern species.

The usual ground color of the carapace is dark brown, marked with sharply-defined yellow, radiating lines. The plastron, as a rule is strikingly marked with yellow lines or bands running in various directions. Occasional specimens are tan or yellowish, with indistinct markings. Curiously enough, the markings, in the elongation of the sharply cut yellow lines, are strikingly similar to the widely separated (geographically) *bauri* of Florida, even to there being a tendency for the latter to have strong linear markings upon the plastron, which may be noted among the illustrations at the conclusion of this article. This condition may point to parallelism without relationship, induced in each instance upon forms inhabiting areas of dry soil—*T. ornata* inclining toward open and rather arid areas, and *bauri* an extension from major stock into the sandy soil of Florida.

Terrapene mexicana (Gray)

MEXICAN BOX TURTLE; THREE-TOED BOX TURTLE

Onychotria mexicana, Gray, Proceedings of the Zoological Society of London, 1849, p. 17, Pl. II.

Distribution: The precise range of this species has not been definitely determined. In the original description is the line: "Hab. Mexico."

"The species seems to penetrate rather far southward into Mexico, as Bocourt mentions it from Tampico and the city of Mexico" (Günther).

"Mexico" (Boulenger).

With *T. mexicana* the zygomatic arch is indicated to be absent, the quadratojugal being very rudimentary and proportionately similar to the skull structure of *T. carolina*.

Gray's original description follows: "In a collection of reptiles recently received from Mexico are two specimens of a Box Tortoise, which, besides differing from the common box tortoise of North America, in being of a more elongated form, both agree in two characters, which are not found in that species or in other species of the genus; first, in having an additional vertebral plate; and secondly, in the hind feet being only armed with three large claws: there is no appearance of the fourth claw, and even scarcely any rudiment fourth toe found in the other species of this genus, and in all other *Emydæ*.

"This species will form a section or subdivision of the genus, which may be called *Onychotria*. * * *

"Shell oblong, dark-brown, pale, spotted and rayed, spot and rays sometimes confused.

"Vertebral plates with a nearly continued keel, and with a small intermediate one between the usual fourth and fifth plates.

"The hinder margin acute revolute.

"The head pale brown; the legs yellow or orange spotted, with five unequal claws.

"The hind legs brown, uniform, with only three large claws, the middle and the front one largest.

"The sternum flat; the gular plates wide in front, and suddenly narrowed behind.

"*Hab. Mexico.*"

Terrapene yucatana (Boulenger)

YUCATAN BOX TURTLE

Cistudo yucatana, Boulenger, the Annals and Magazine of Natural History, Vol. XV, Series 6, London, 1895, pp. 330-331. (No figure.)*

Distribution: Not definitely described, but indicated as easternly Mexico, including the Yucatan peninsula. A specimen examined by the writer and illustrated in an accompanying plate is marked "Near Tampico."

Preceding Boulenger's description of *yucatana* is a key to six species. *Yucatana* falls into a grouping: "No bony temporal arch—quadratojugal bone vestigeal." The description follows:

"In shape and size (length 145 mm.) the shell of *C. yucatana* resembles more *carolina*, but it is, in one of the specimens, rather more elongate. The shields of the carapace are yellowish, bordered with dark brown and with some irregular brown spots, or nearly uniform dark brown. The plastron is yellow, with large, dark brown blotches, or dark brown with the borders of the shields yellow.

"The suture between the gular shields is longer than that between the pectorals, and that between the anal shields is nearly as long as the distance which separates them from the plastral hinge."

An example in the author's possession has four claws on the hind foot.

Terrapene nelsoni Stejneger

NELSON'S BOX TURTLE

Terrapene nelsoni, Stejneger, Journal of the Washington Academy of Sciences, Vol. 15, No. 20, December, 1925.

Stejneger's original description follows:

"*Diagnosis.*—Nostrils vertically oval, close together, not visible in side view of head; hind feet with four claws; three phal-

*While the description is not in the usual form of presentation of a new species, there appears to be no former outline of *yucatana*. Siebenrock in his synopsis of the recent turtles cites this reference as the original.*

anges in middle digit of fore foot; carapace with a median keel anteriorly; digits scarcely webbed; no bony temporal arch; upper jaw hooked, not notched in the middle; first marginal lamina almost as long as width of first central lamina; length of first central equals width of third central; fourth central shorter than width, shorter than first.

"*Type*.—U. S. National Museum No. 46252; adult.

"*Type locality*.—Pedro Pablo, Tepic, Mexico; 2500 feet altitude.

"The type is unique and is one of two specimens of box turtles, the only ones obtained by Dr. E. W. Nelson and E. A. Goldman during their many years of collecting in Mexico. It is dedicated to Dr. E. W. Nelson, Chief of the U. S. Biological Survey, in recognition of the splendid work done by him and his organization in making known the vertebrate fauna of that country."

The photographic illustrations of this species were received from the United States National Museum, through the courtesy of Dr. Leonhard Stejneger.

Terrapene goldmani Stejneger

GOLDMAN'S BOX TURTLE

Terrapene goldmani, Stejneger, Proceedings of the Biological Society of Washington, Vol. 46, pp. 119-120, June 30, 1933.

Stejneger's original notes and description follow:

"The following description has been held back for many years in the hope of obtaining additional material. However, box turtles appear to be so rare in Mexico that it is deemed advisable to make the present one known now, although based on a single specimen only. * * *

"*Diagnosis*.—Nostrils oval, very close together; hind feet with three toes, clawed; three phalanges in middle digit of fore foot; digits scarcely webbed; no bony zygomatic arch; upper jaw hooked, not notched; first marginal much shorter than width of

first central at middle; length of first central equals width of third central; fourth central longer than wide, as long as first; interhumeral seam more than two-thirds the length of interpectoral seam; color above and below nearly uniform 'clay-color' with well-defined broad dark-brown margins to each lamina along the seams.

"*Type*.—U. S. National Museum, No. 46251; ad. fem.

"*Type locality*.—Chijol (or Chijoles), southeastern corner of the State of San Luis Potosi, Mexico; in the coast plain.

"*Collectors*.—E. W. Nelson and E. A. Goldman, May 11, 1898.

Dimensions in mm.

Length of carapace (straight line).....	151
Width of carapace (at 7th marginal).....	110
Length of plastron (straight).....	144
Width of plastron (at middle of femorals).....	88
Anterior plastral lobe.....	61
Posterior plastral lobe.....	87
Height of body (at 2-3 centrals).....	75
Length of first marginal.....	18
Length of first central.....	36
Width of first central at middle.....	33
Width of third central.....	36
Length of fourth central.....	36
Width of fourth central.....	32
Interhumeral seam	17
Interpectoral seam	23
Eye to nostril.....	6.5
Diameter orbit	9.5
Width of head.....	22

"Named in honor of Major E. A. Goldman of the U. S. Biological Survey in recognition of his splendid work in the exploration of the Mexican fauna."

The photographic illustrations of *goldmani* were received from the United States National Museum, through the courtesy of Dr. Leonhard Stejneger.

Summary: With the species of *Terrapene* viewed collectively, the present status of this genus would appear to be rather provisional. Additional material may indicate interesting disclosures in intergradation. The standing of *triunguis*, with its possible close relationship to *carolina*, and the same condition with *bauri* and *major*, may be altered with extended examination of further specimens. Certain it is, that the preparation of a key

to the box turtle genus now presents a problem. With Lönnberg's dispute of the old mainstay—the zygomatic arch—as a staple character for diagnosis, the recently shown tendency for *bauri* to possess either three or four claws on the hind foot, for webbing to vary, number of phalanges not to hold good, "notched" or "not notched" upper mandible to be dubious points for subdivision of a key, entirely new points, not at the present evident, must be defined.

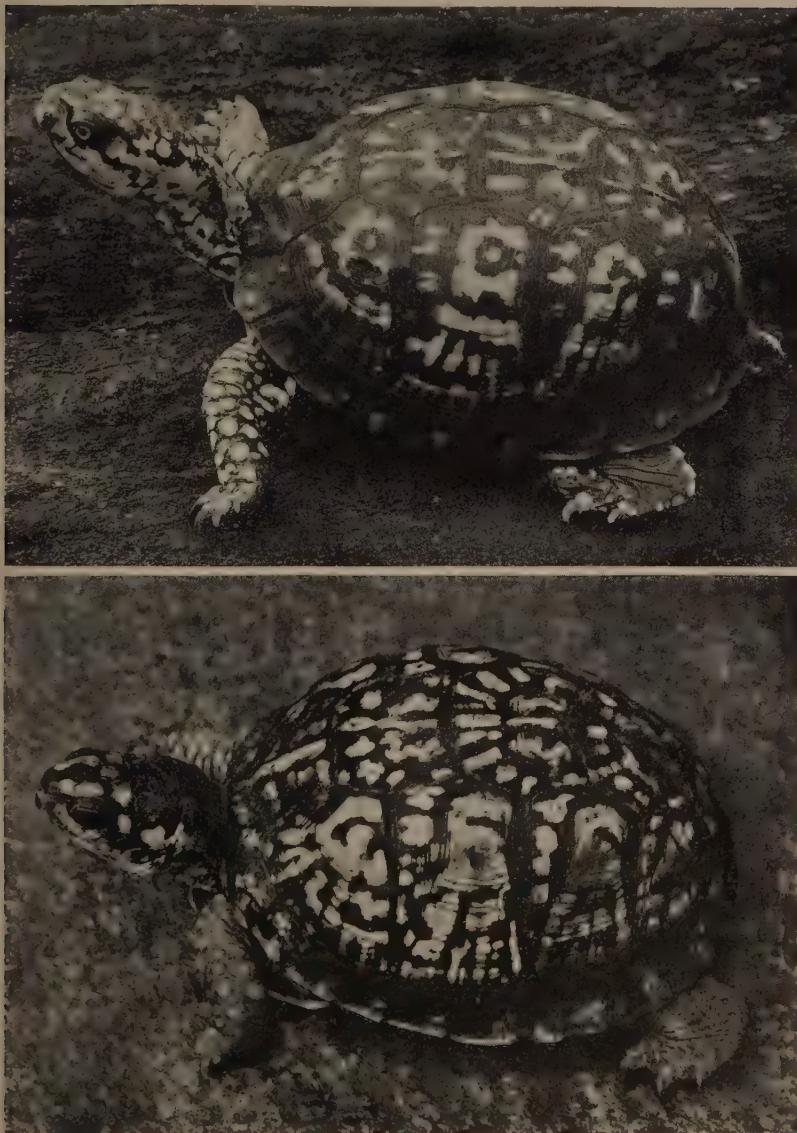
*TERRAPENE CAROLINA.*

Fig. 1.—(Upper) Male, from Palisades of the Hudson, near Fort Lee, New Jersey. The strong, orange-yellow markings on head and forelimbs are commonly noted on male examples, and the eyes are usually bright red.

Fig. 2.—(Lower) Female, from same locality as upper specimen, with E-like markings on shell, a frequent pattern among eastern examples.

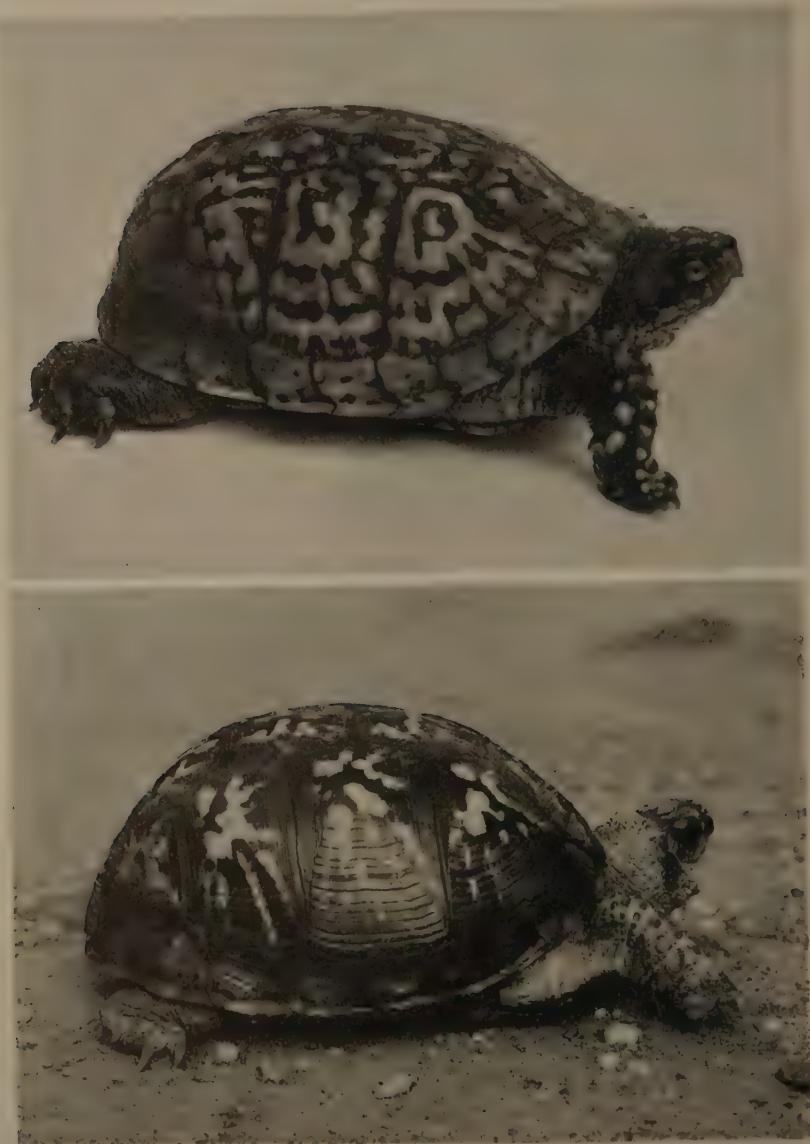
*TERRAPENE CAROLINA*

Fig. 8.—(Upper) Male, from Westchester County, New York, with paler markings predominating.

Fig. 4.—(Lower) Female, from Palisades of the Hudson, near Fort Lee, New Jersey, showing reverse of amount of yellow markings from specimen above, including absence of markings on head and limbs.

*TERRAPENE CAROLINA*

Figs. 5 & 6.—(Upper) Female, with flare at posterior margin of carapace, compared with female (lower), with practically no flare. Shell flare is particularly evident among males, but variable from pronounced extent, to slight trace of it. Both examples from Westchester County, New York.

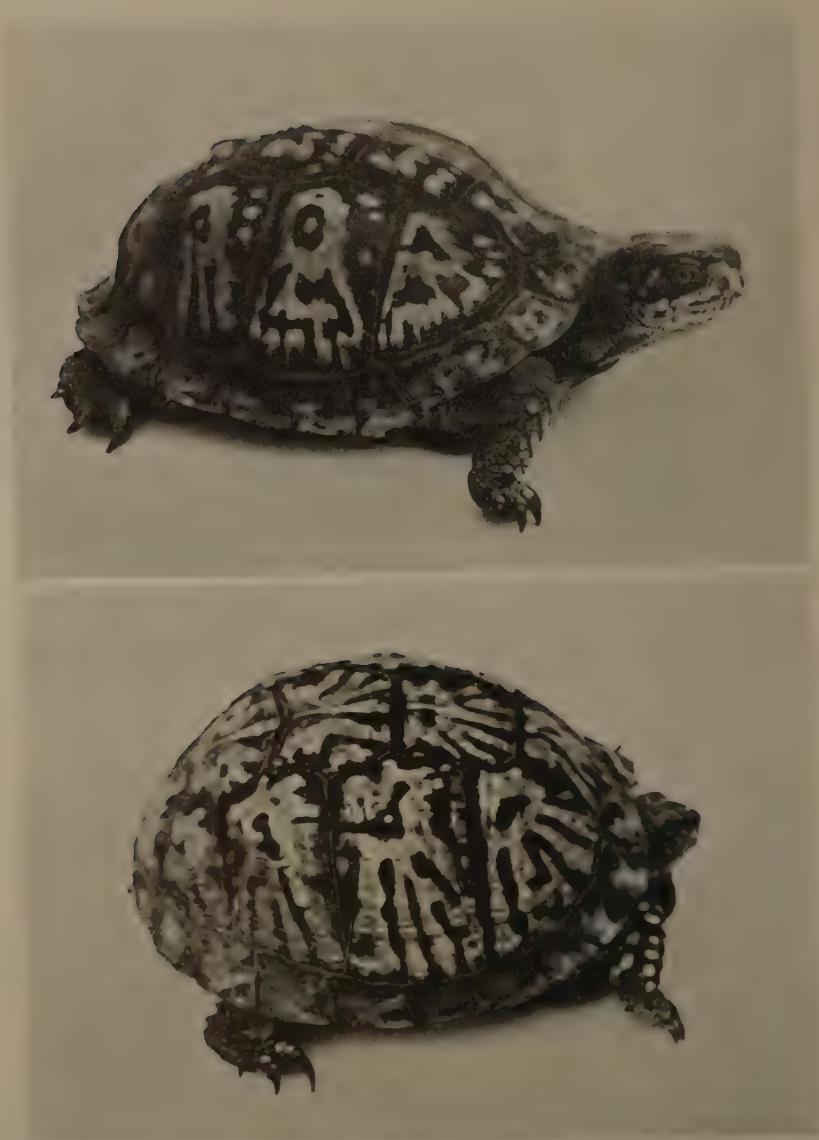
*TERRAPENE CAROLINA*

Fig. 7.—(Upper) Male, from Westchester County, New York.

Fig. 8.—(Lower) Female, from north shore of Long Island (near Gardiner Island). The carapace is so sharply declivitous as to produce a particularly globular aspect. The markings are unusual.



TERRAPENE CAROLINA

Figs. 9 & 10.—Both examples were collected on the Palisades of the Hudson, near Fort Lee, New Jersey. They illustrate the wide variation in markings among box turtles observed in immediate proximity.

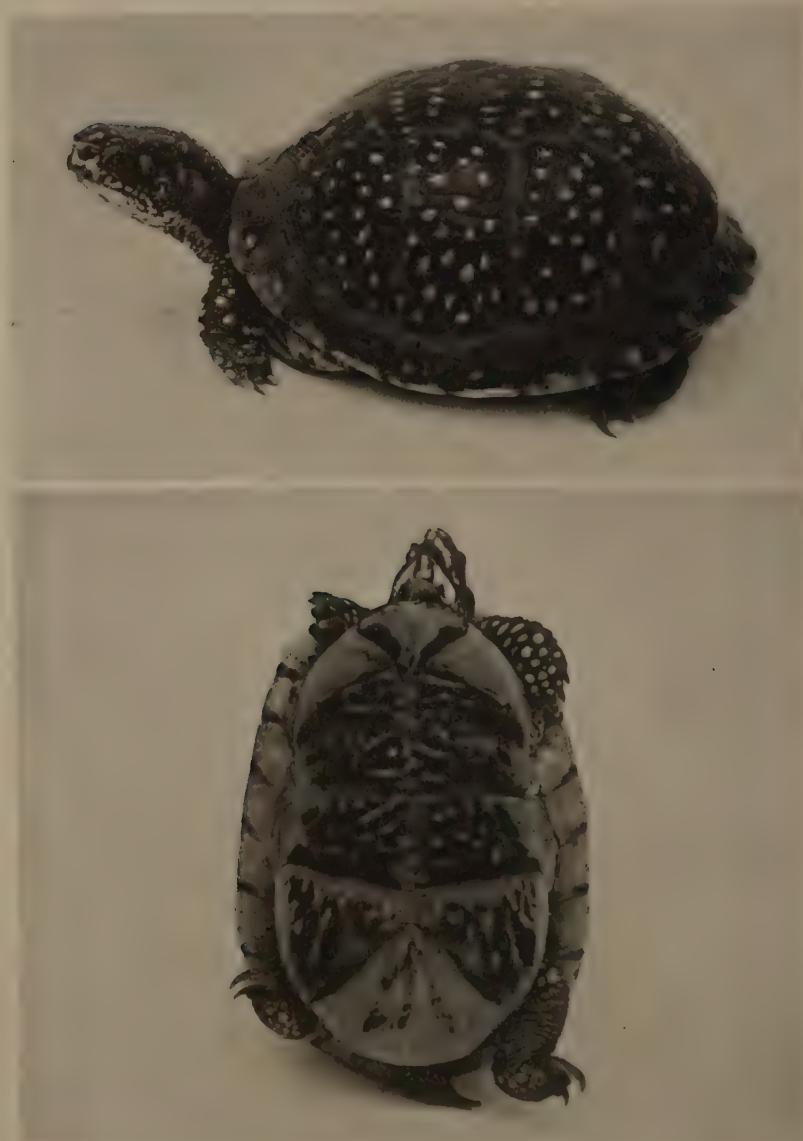
*TERRAPENE TRIUNGUIS*

Fig. 11.—(Upper) From Imboden, Arkansas. The species is variable in its markings, although there is a tendency for bands of bright orange on the snout and chin.

Fig. 12.—(Lower) Female, from Imboden, Arkansas. Separate example from above.

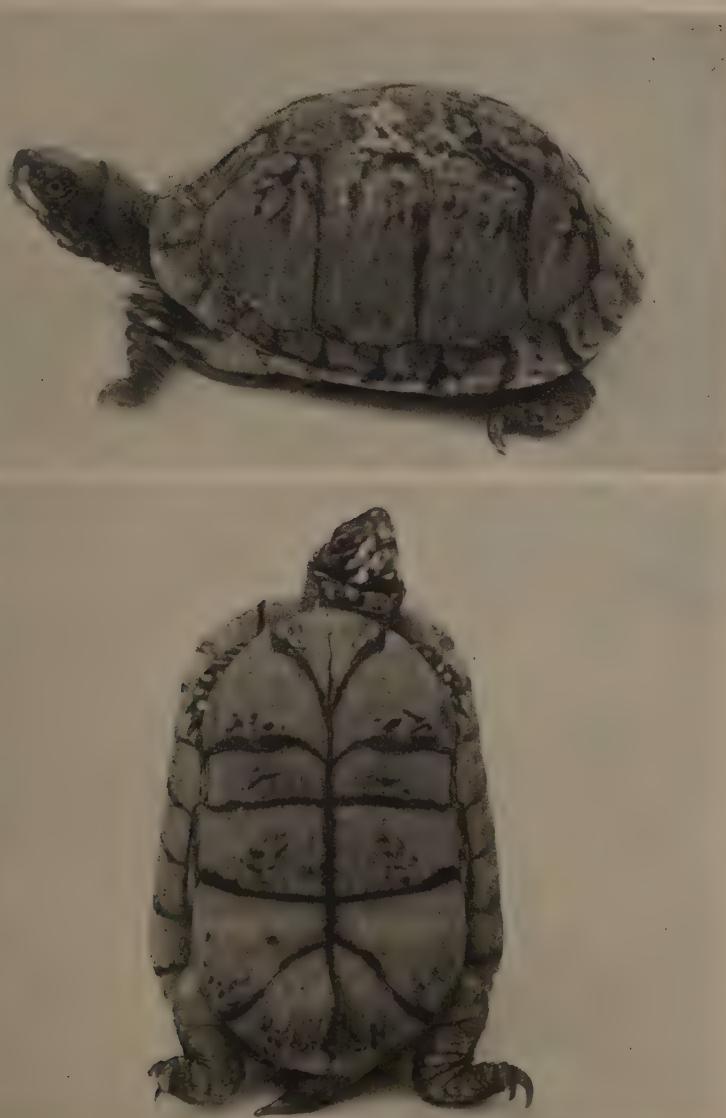
*TERRAPENE TRIUNGUIS*

Fig. 13.—(Upper) Horn-colored female, from Hammond, Louisiana. Yellowish examples with obscure markings, or no markings, are not uncommon.

Fig. 14.—(Lower) Plastron of the example shown above. The plastron varies from well-marked, to sparse cloudings. Note the pale bands on upper and lower mandibles.

*TERRAPENE MAJOR*

Fig. 15.—(Upper) Female, collected near New Orleans, Louisiana.

Fig. 16.—(Lower) Female, same locality as above, with more typical markings, showing the inclination for the yellow spots or bands to be rather symmetrically radial, particularly with examples from easterly parts of the range.

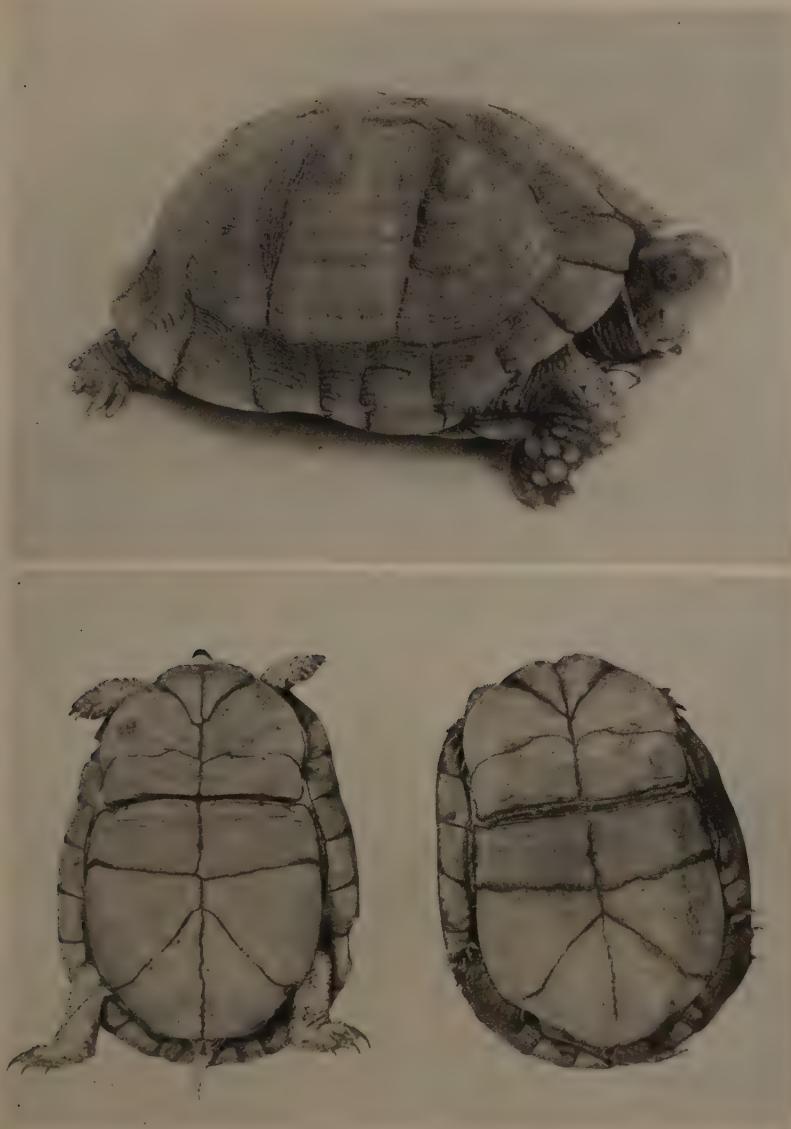
*TERRAPENE MAJOR*

Fig. 17.—(Upper) Yellow female, without markings, collected near New Orleans, Louisiana. There is a common tendency with *major*, at least in the central part of its range, for the occurrence of horn-colored, olive, or yellowish specimens.

Fig. 18.—(Lower) Examples from Louisiana. The plastron is usually yellowish or olive, with no markings except narrow darkening at sutures between the shields.

*TERRAPENE BAURI*

Fig. 19.—(Upper) *Bauri* may be grossly defined by its elongated, radial markings. The chin is yellowish, the head dark and often with two bands behind the eye. Example from Marion County, Florida.

Fig. 20.—(Lower) From Marion County, Florida. Note difference from upper figure in shell flare. This is usually more pronounced with males, but in indicating sex does not always hold good.



TERRAPENE BAURI

Fig. 21.—(Upper) Common type of markings, with yellow or greenish-yellow, elongated and sharply defined bands. Marion County, Florida.

Fig. 22.—(Lower) The head with yellowish chin, is typical of *bauri*, but the crowded and broken markings are more like *major*. Marion County, Florida.

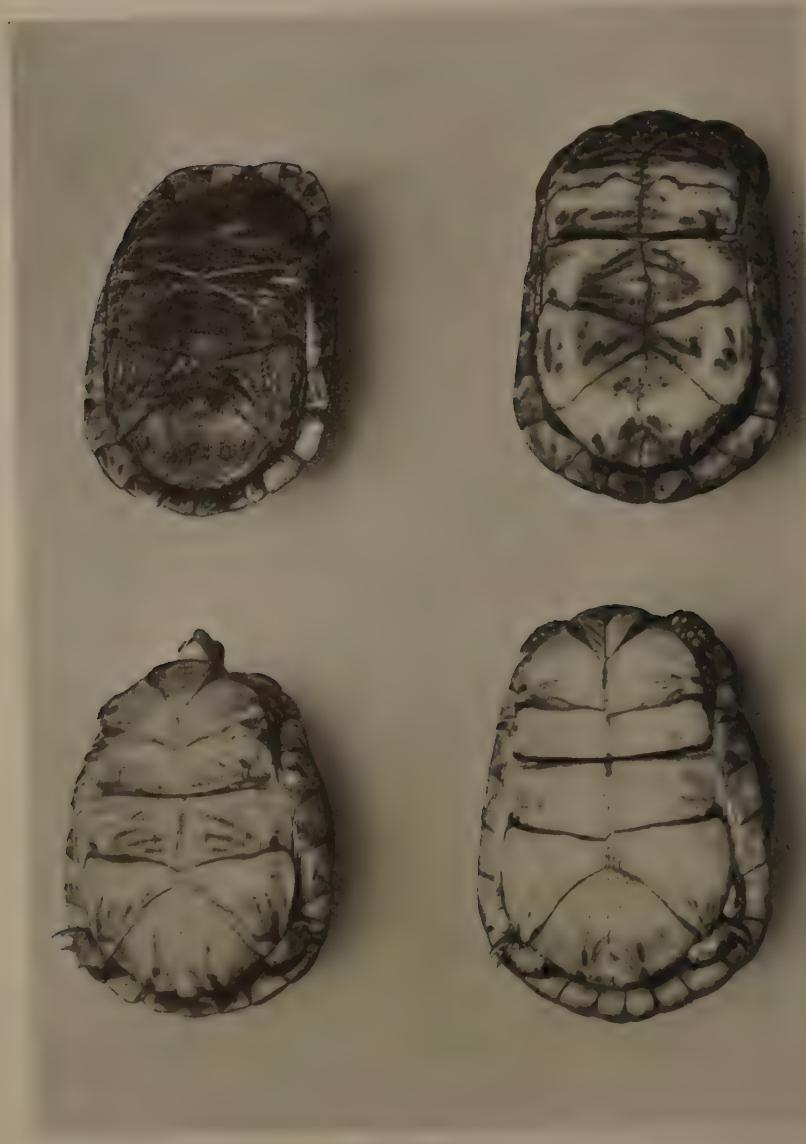
*TERRAPENE BAURI*

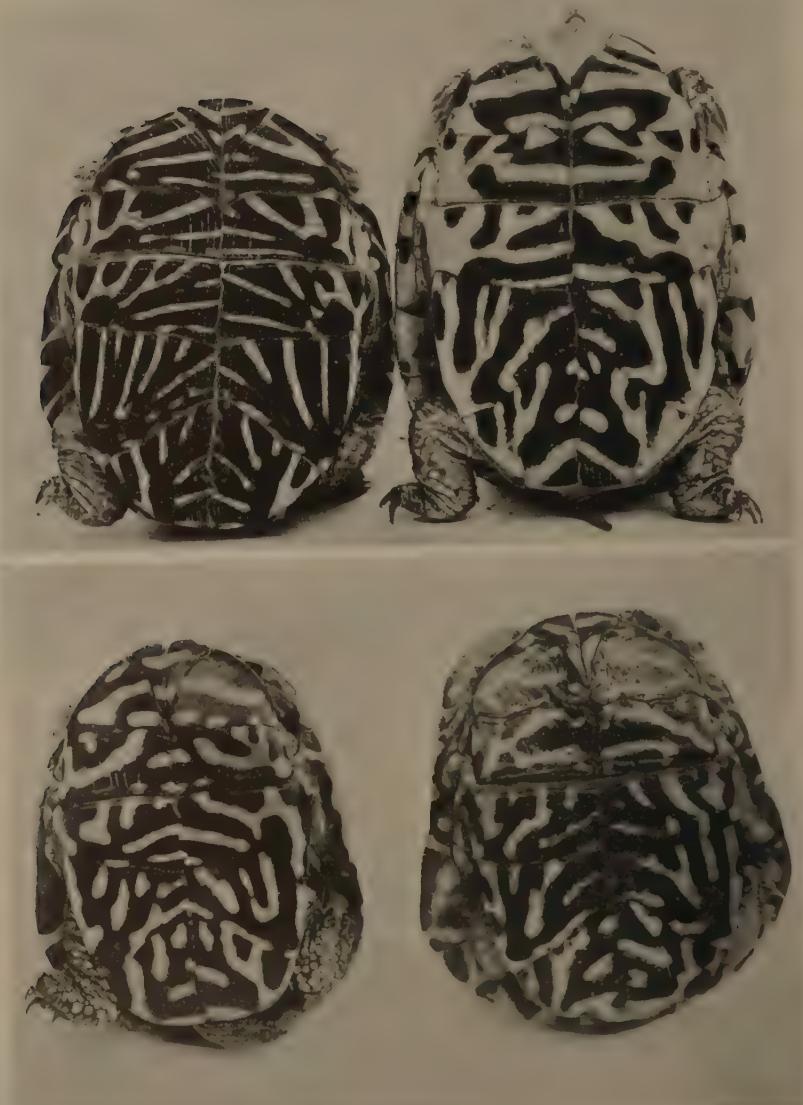
Fig. 23.—There is much variation in the presence of dark, parallel markings on the plastron. The concavity on the plastron of upper, right figure is typical of the males of all box turtles. The female, at lower left, has four claws on the hind foot. All examples are from Marion County, Florida.



TERRAPENE ORNATA

Fig. 24.—(Upper) Commonly marked example. Female, collected near Amarillo, Texas.

Fig. 25.—(Lower) Female, from Amarillo, Texas. The markings in this instance are strikingly similar to the widely separated (geographically) *T. bauri*.

*TERRAPENE ORNATA*

Figs. 26 & 27.—Markings on the plastron vary. Either the ground color or the yellow bands predominate.

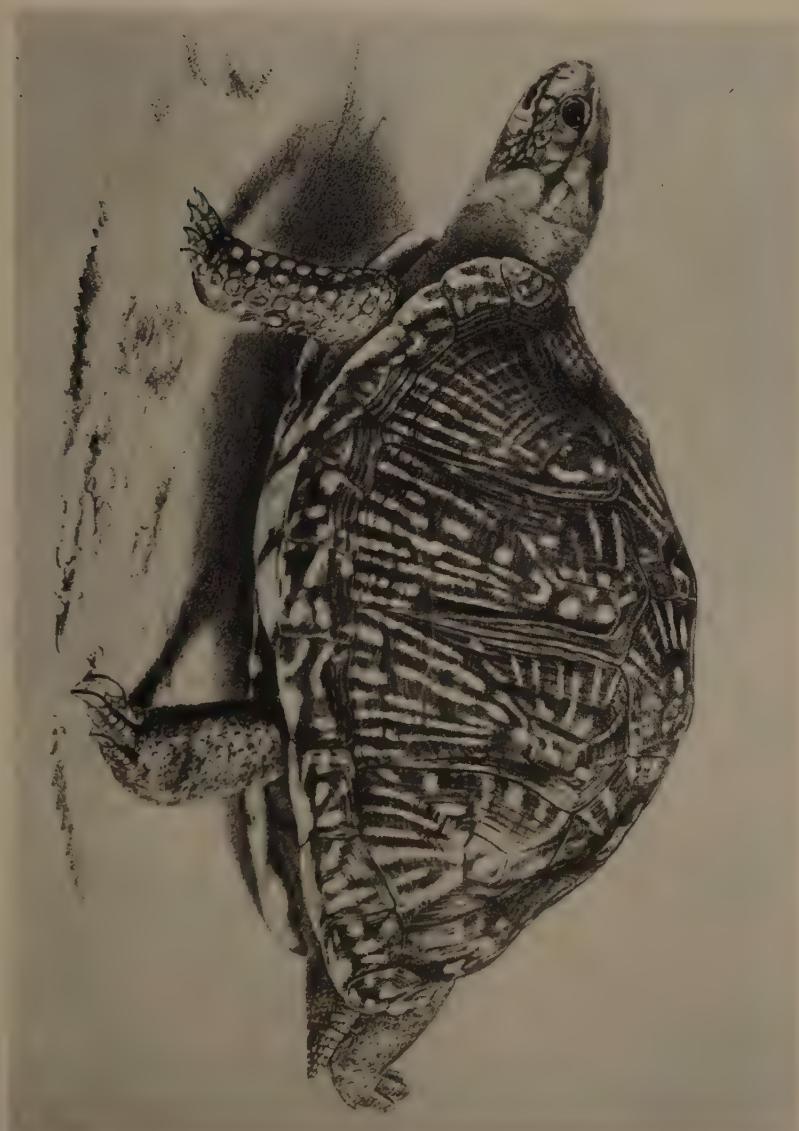
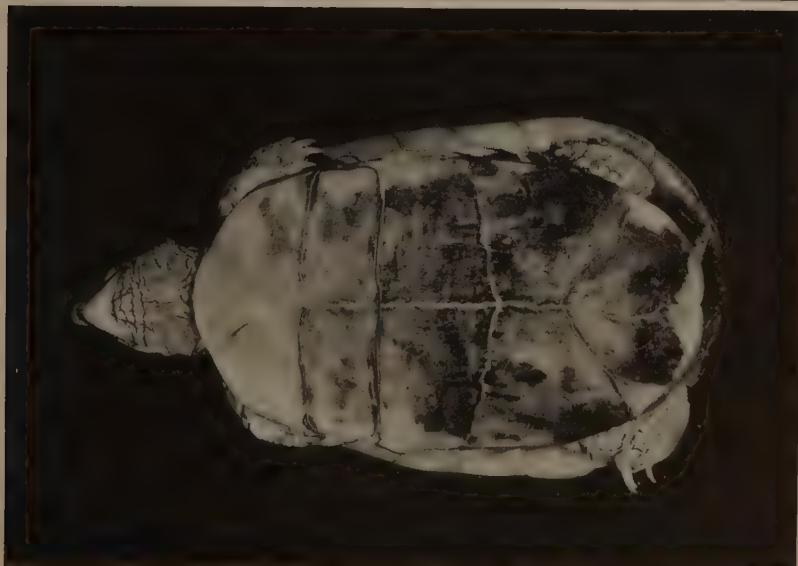
*TERRAPENE MEXICANA*

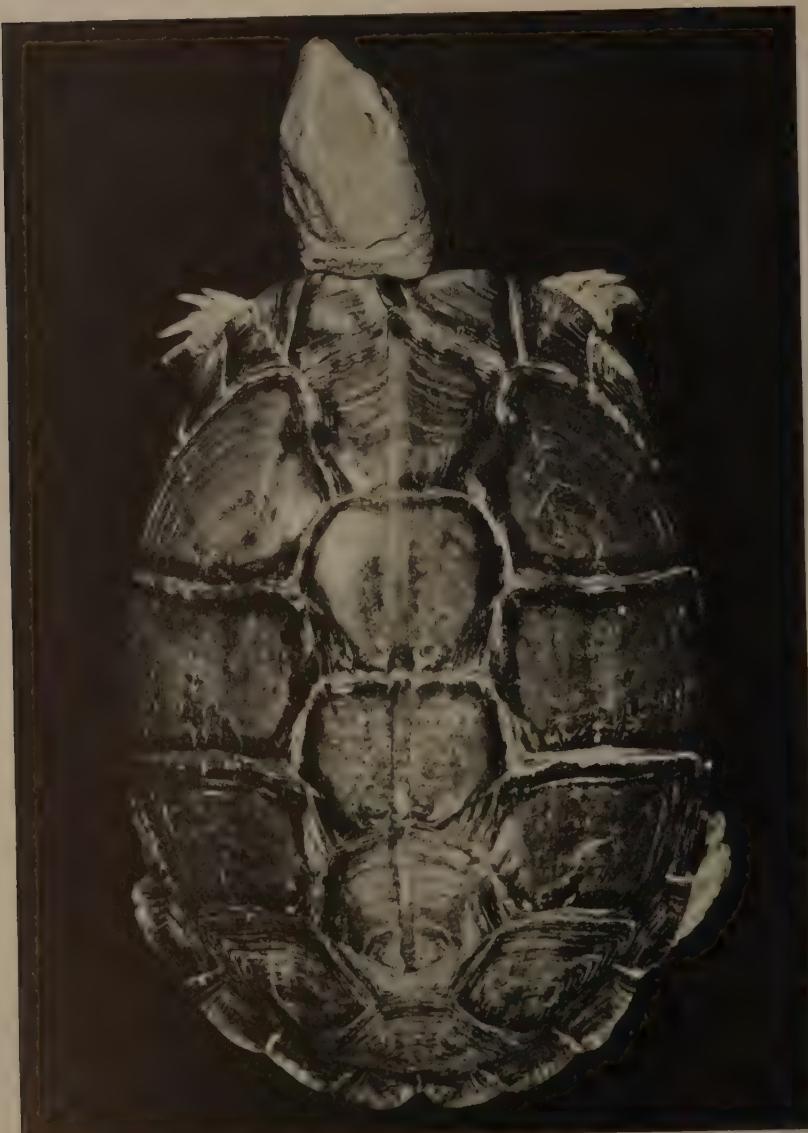
FIG. 28.—From Gray's plate, entitled *Cistudo (Onychorhiza) mexicana* Gray. This plate appeared in connection with the original description of the species on page 16, Proceedings of the Zoological Society of London, Part XVII, 1849. Locality of type: "Mexico".

*TERRAPENE YUCATANA*

Figs. 29 & 30.—The photographs relate to the same individual. It is apparently quite old, as indicated by the smooth shell. The coloration is dull olive, with a smokey hue at the sutures. Collected near Tampico, Mexico.

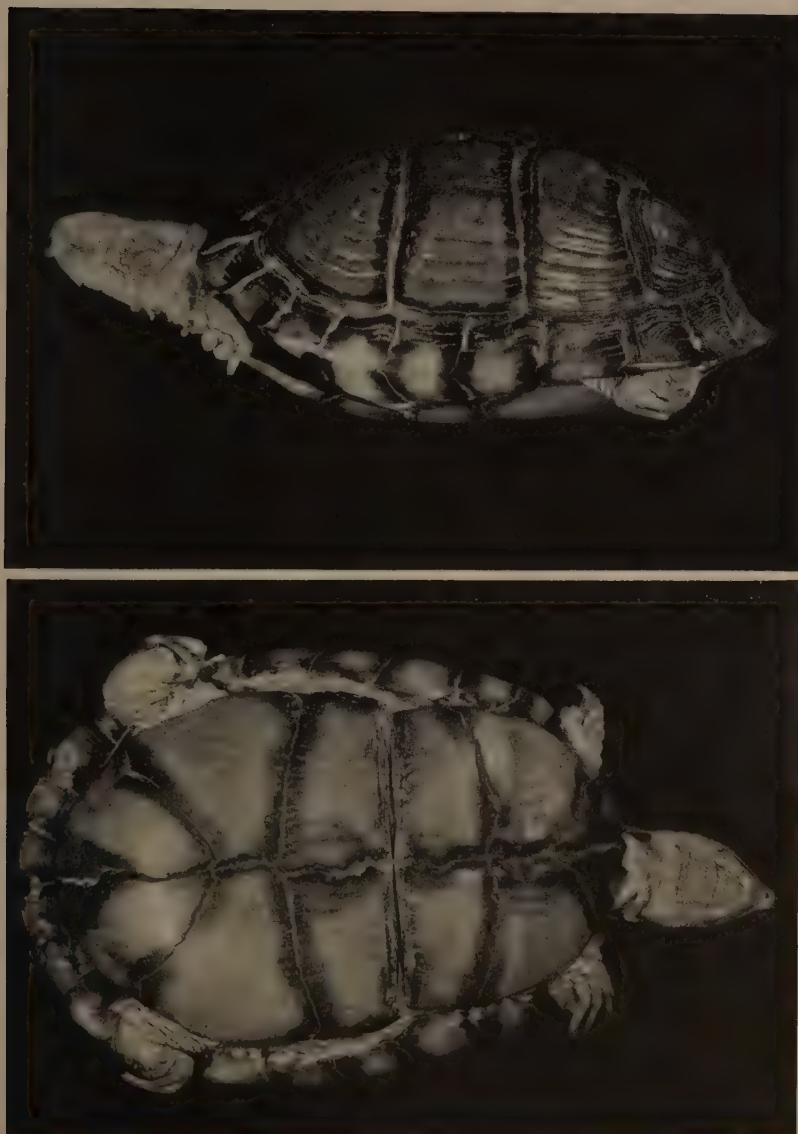
*TERRAPENE NELSONI*

Figs. 31 & 32.—The type specimen, from Pedro Pablo, Tepic, Mexico, at 2,500 feet elevation. Photographs from the United States National Museum, through the courtesy of Dr. Leonhard Stejneger.



TERRAPENE NELSONI

Fig. 88.—The type specimen, from Pedro Pablo, Tepic, Mexico, at 2,500 feet elevation. Photograph from the United States National Museum, through the courtesy of Dr. Leonhard Stejneger.

*TERRAPENE GOLDMANI*

Figs. 34 & 35.—The type specimen, from Chijol (or Chijoles), southeastern corner of the State of San Luis Potosí, Mexico; in the coast plain. Photographs from the United States National Museum, through the courtesy of Dr. Leonhard Stejneger.

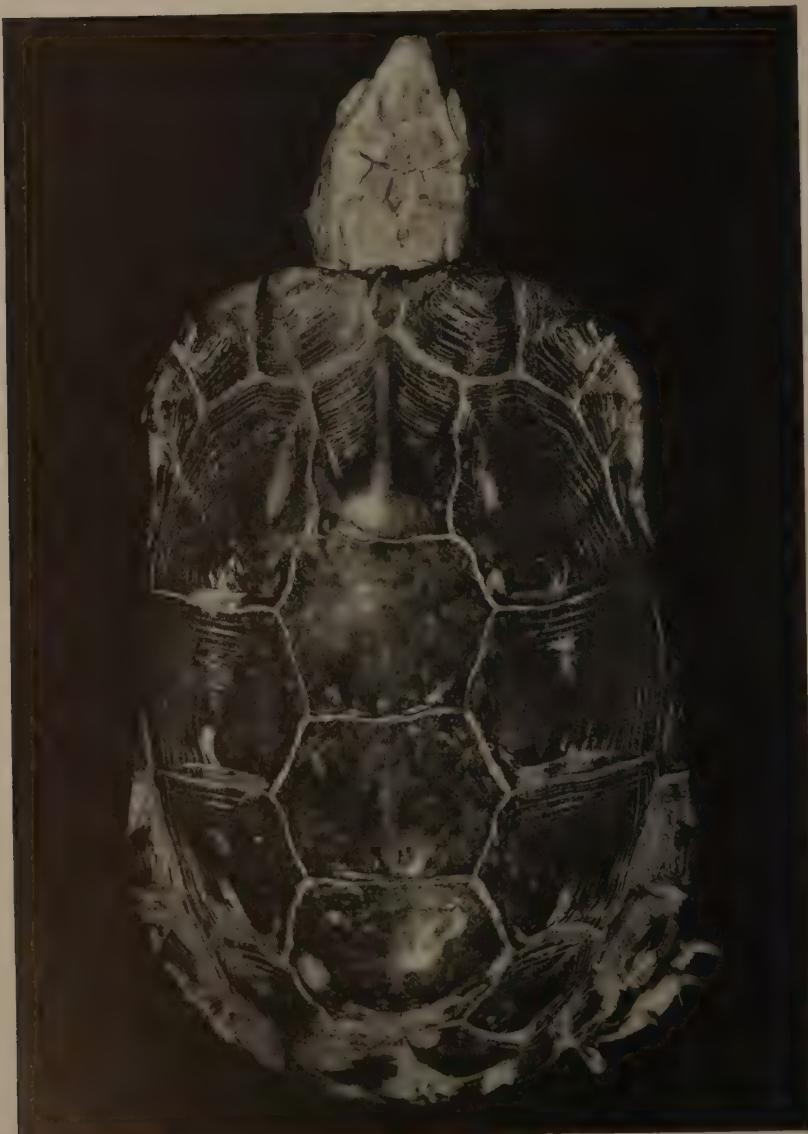
*TERRAPENE GOLDMANI*

Fig. 36.—The type specimen, from Chijol (or Chijoles), southeastern corner of the State of San Luis Potosí, Mexico; in the coast plain. Photograph from the United States National Museum, through the courtesy of Dr. Leonhard Stejneger.

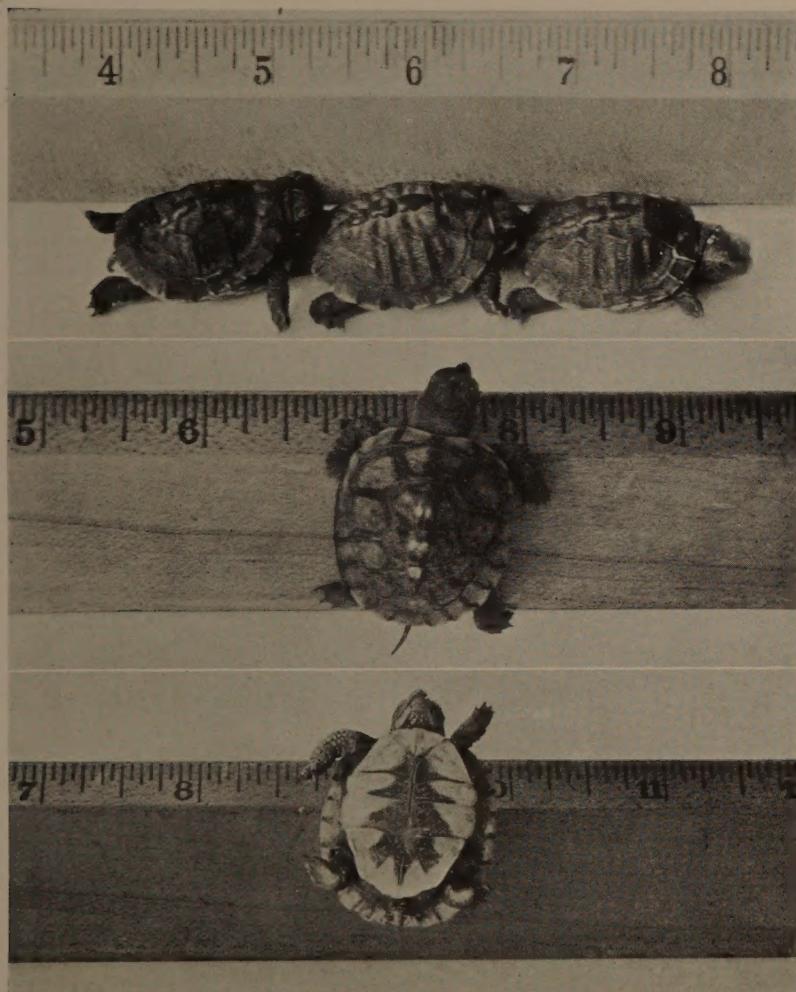
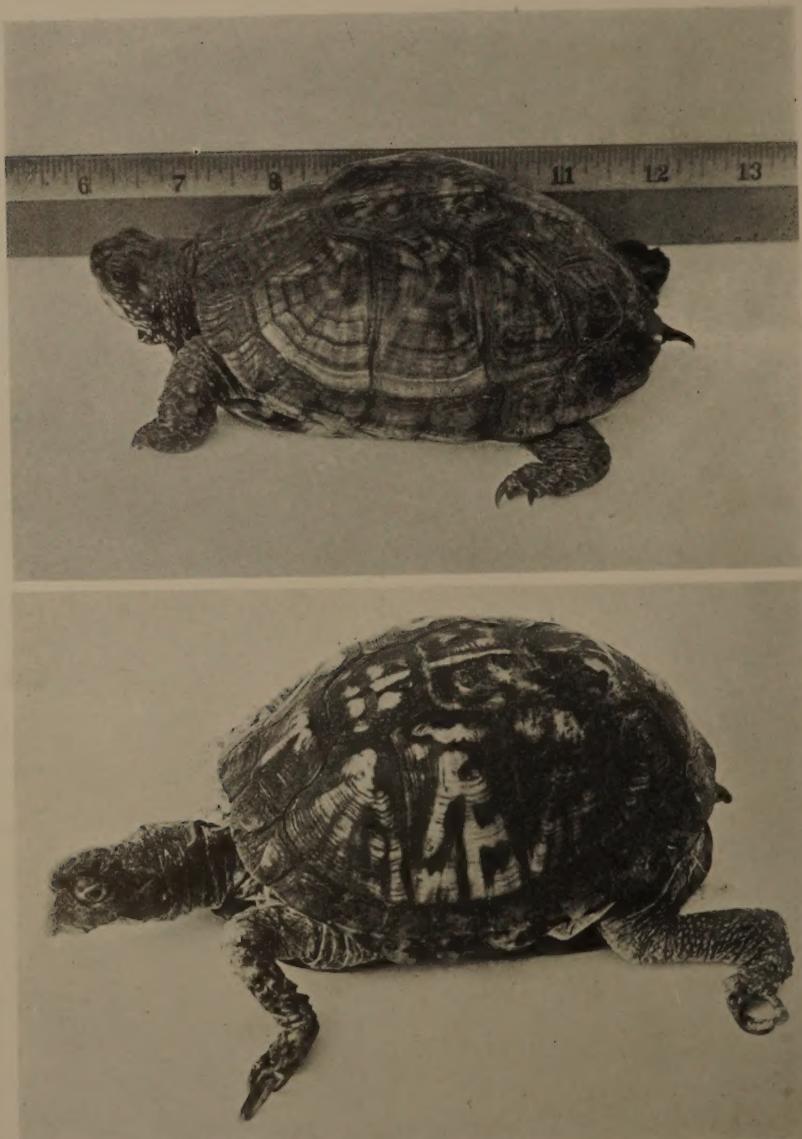


Fig. 37.—Young box turtles hatched October 8, 1932 and photographed January 15, 1933. (Specimens in the collection of Miss Marion Bush.) All specimens on this page are of *T. carolina*.

Figs. 38 & 39.—From egg laid June 21, 1932 and hatching September 21. Photographed November 10, the same year. Mr. William R. Potts, who made the observation explains: "About the size of a nickel at time of hatching. Was taken indoors and when photographed fifty days after hatching, had increased about one hundred per cent in size." The lower figure shows the plastron of the same specimen, with characteristic marking of young examples.



YOUNG ADULT AND OLD EXAMPLES OF *TERRAPENE CAROLINA*

Fig. 40.—(Upper) Specimen hatched October 9th, 1927, from egg laid the preceding June 22nd. Photographed in January 1933, having attained adult dimension in approximately five years. The rings of annual growth, on the shields of the carapace, are clearly apparent. (Collection of Marlon Bush.)

Fig. 41.—(Lower) Example under observation for twenty-seven years, in a farm house, in Westchester County, New York. It was full grown when first captured. The abnormal upper mandible, and elongated claws may be accounted for by the specimen having been kept mostly indoors.

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